

# Digital Cameras

In a relatively short period of time, since 1994, digital technology has mounted a serious challenge to an established way of taking photographs; Fox Talbot became the father of modern photography about a hundred and sixty years ago. Film-based photography has a number of advantages: film is relatively cheap; it has reasonably good storage properties and offers superb quality if the correct choice of equipment is made.

What are the attractions of digital photography? Its immediacy is a major factor, within minutes of taking a photograph it can be either processed into a hard copy image, sent by e-mail via mobile or satellite phone to a newspaper picture editor or even uploaded to a web page on the 'net.

## How do they work

Similar to a film camera a lens is used to focus an image onto a light sensitive device, these signals are then processed in an Analogue to Digital Converter (ADC), passed through a Digital Signal Processor (DSP) to be stored on a removable memory card. Depending on the camera system in use it is possible

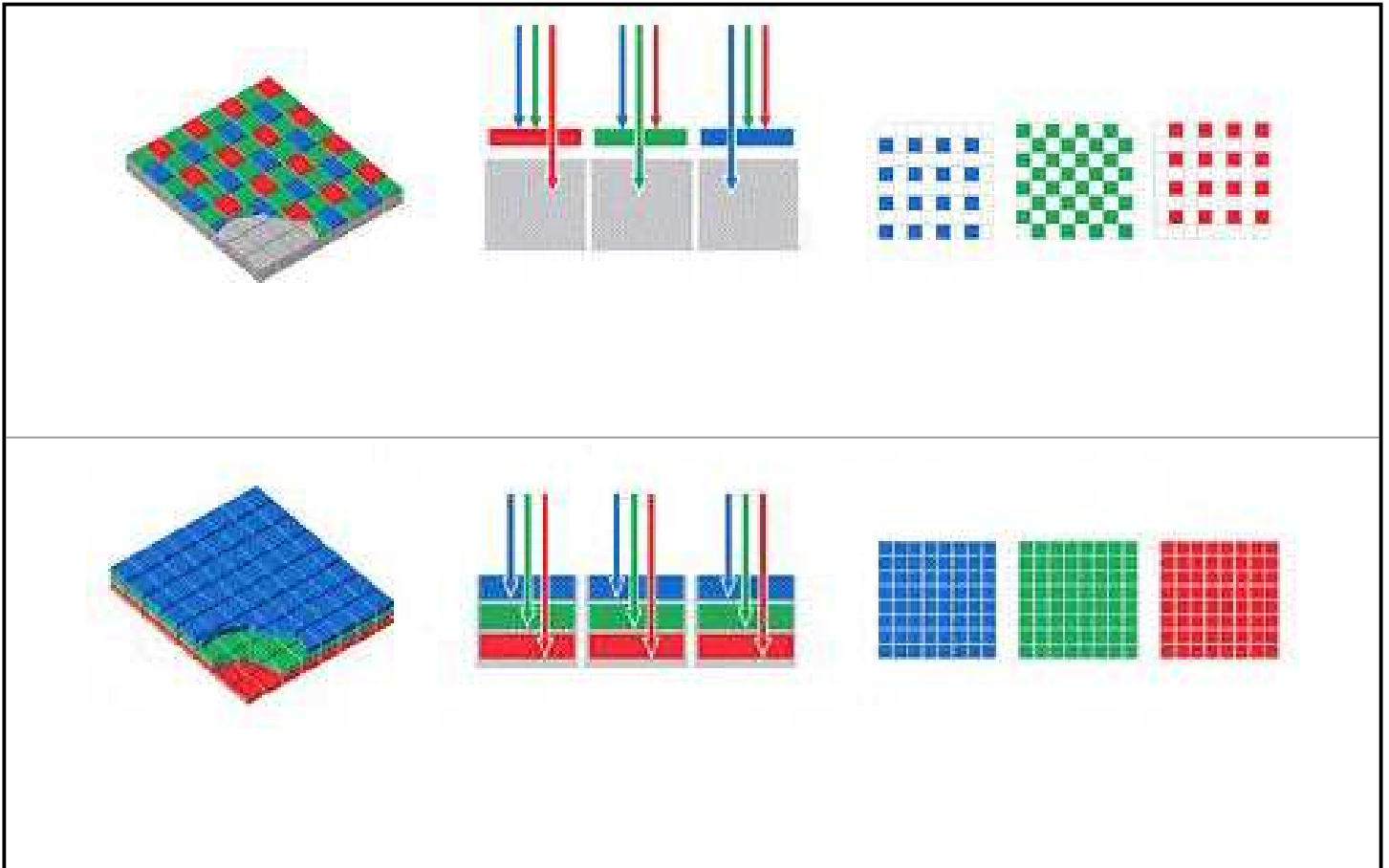
to obtain high picture definition and compact file size using a lossless compression system of RAW data, this eliminates image deterioration, provides superior pictures without sacrificing original image quality.

RAW data can converted into high quality TIFF and JPEG formats by dedicated image processing software within the camera, or the RAW data can be exported from the camera to image processing software on a computer.

In many of the consumer type cameras it is possible to choose to save the image as a high quality TIFF image with no loss in quality or as a JPEG with some acceptable loss in quality.

## Sensors

In all cameras other than those used by the professional or prosumer photographers, the image sensor is quite small compared with the dimensions of a 35mm film image i.e. 24 x 36mm. In the recently introduced Olympus C-730UZ camera the image sensor is 0.370 inches or 9.4mm wide with 3.2 effective megapixels. Whereas the Canon EOS 1Ds has a sensor with 11.1 megapixels and measures 24 x 36mm.



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There are three distinct types of image sensor used in digital cameras the Charge Coupled Device (CCD), the Complementary Metal Oxide Semiconductor (CMOS) and the Foveon X3.

The problem with the CCD and CMOS sensors is that they do not naturally see in colour, they only respond to the intensity of light. A solution to this problem is to use a Bayer filter to give a red, green and blue image, the effect of this mosaic pattern is that they typically capture 50% of the green, 25% of the red and 25% of the blue light. From this filter pattern the colour of a pixel can be interpolated from the pixels on its adjacent four sides. This results in a resolution that is one third of that of an equivalent sized monochrome image

Some companies claim to provide better colour resolution by tweaking the interpolation algorithm or by providing a sensor which has more than four sides e.g. Fujifilm's Super CCD sensor. However the problem remains that with these types of sensor, CCD and CMOS, colour resolution is reduced and there tends to be evidence of patterning and fuzziness known as artefacts present due to this type of image capture.

A new type of sensor has recently been incorporated into a digital camera, the Sigma SD9. The Foveon X3 has a three-layer sensor that allows light of the correct colour to penetrate to the correct depth. The result is a sensor that not only has a true colour resolution equal to the number of pixels it claims to have, but the colour quality is also much better and doesn't show any of the strange patterning of the Bayer filter. The effective pixels in the Sigma SD9 are quoted as 3.43 Million X3™ Full Colour Pixels consisting of 2268 Columns x 1512 Rows x 3 Layers giving a total of 10.29 effective megapixels.

Should you wish to see examples of images produced by the Sigma SD9 camera visit:[http://www.foto-erhardt.de/modules.php?name=Testbilder&d\\_op=viewdownload&cid=67](http://www.foto-erhardt.de/modules.php?name=Testbilder&d_op=viewdownload&cid=67)

Where there are seven images that can be downloaded and printed.Also:

<http://www.dpreview.com/news/0209/02092702sigmasd9samples2.asp>

Where there are fourteen images, complete with all technical details and an explanation of the RAW processing software provided with this camera.

### Lenses

In many of today's digital cameras the lenses are small in comparison with lenses used on 35mm film cameras, the main reason for this is the smaller area of the image sensor that needs to be covered, this leads to shorter focal length lenses being used and for manufactures to quote the equivalent to 35mm film camera focal length.

A general rule is that a ' normal' lens (as opposed to wide-angle or telephoto lens) has a focal length that's about the length of the diagonal of the image so:

Digital	Photo	Lens
5.4mm	35mm	Wide angle
7.7mm	50mm	Normal
16.2mm	120mm	Low telephoto

However, most manufacturers of film cameras make a digital camera which will take there own range of interchangeable lenses, there are a few exceptions including Kodak and Fujifilm who use a modified Nikon body, which will take the Nikon range of interchangeable lenses.

Many of today's digital cameras use optical zoom lenses, many also use digital zoom either on its own or in conjunction with optical zoom. With optical zoom the lens changes focal length and image quality is maintained, whereas digital zoom enlarges a portion of the image sensor. The same effect can be achieved with photo editing software and a better job would be made, especially if bicubic interpolation is chosen, the image is enlarged in a much more satisfactory way than the camera can carry out this operation.

### Exposure

Like their 35mm film camera partners, digital cameras in the mid to upper price ranges have the ability for the user to choose various types of shooting modes, fully automatic, aperture or shutter priority and some have the ability to have a sports, portrait and landscape settings to help users to

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produce good images. Some have thorough the lens viewing and almost all have the ability of previewing the image on a small LCD/TFT screen. Many digital cameras now have adjustable film speed settings, more accurately they adjust the image sensor's sensitivity. Some now have the ability of bracketing the exposure either side of the chosen setting so that a correctly exposed image is almost guaranteed.

### **Image Transfer**

Almost all digital cameras use some form of removable storage media, xD the newest, Memory Stick, Compact Flash, Secure Digital (SD), Microdrive, Floppy Disc and CD-R/RW 1.902Mb capacity. Most cameras can be connected directly to a computer either using serial, USB or FireWire connectivity, or memory cards can be placed in a variety of single card or multi card adaptors connected directly to the computer.

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